SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-47

Name: Curlew Lake **County**: Meade

Legal description: Sec 2, 10, 11, T 3N, R 11E
Location from nearest town: 8 mi. N, 4 mi. E, 1.5 mi. N of New Underwood, SD
Dates of present survey: May 27-29, August 4, September 16, 2014
Date last surveyed: June 10-12, July 29, 2013
Management classification: Warm water permanent

Primary Species: (game and forage)	Secondary and other species:
1. Black crappie	1. Bluegill
2. Largemouth bass	2. Yellow perch
3. Walleye	3. Black bullhead
4. Gizzard shad	4. Northern pike
5.	5. Channel catfish
6.	6. Common carp
7.	7. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 136 acres **Watershed:** 12,800 acres
Maximum depth: 22 feet **Mean depth:** 10.2 feet
Lake elevation at survey (from known benchmark): full

Ownership of lake and adjacent lakeshore property:

Curlew Lake is owned and managed by the South Dakota Department of Game, Fish and Parks (SDGFP). All land bordering the immediate shoreline, excluding three quarter sections in Section 2 and a small tract of land comprising 10 acres in Section 11, are owned by the Department of Game, Fish and Parks. The 10-acre tract in Section 11 has a written access agreement with the landowner; the three quarter sections in Section 2 do not have active access agreements. There is no record of problems regarding public access across this section of land.

Fishing Access:

Fishing access at Curlew Lake is good for boat and shore anglers alike. Curlew Lake has a gravel road leading to a relatively new boat ramp with a dock. Shore access is good with trails around much of the lake including the dam face. When conditions are wet; however, trails around the lake are soft and slippery. Typically, emergent and submerged vegetation is sparse around the lake offering shore anglers ample opportunity.

Observations of Water Quality and Aquatic Vegetative:

Rooted aquatic vegetation appears along most of the shoreline, but is not real heavy. Bulrush is the primary emergent plant species associated with the lake. Coontail and Sago pondweed are the most abundant submersed vegetative species in the lake. Siltation at inlets and shorelines

due to natural erosion around the reservoir and cattle grazing on the private tract and its shoreline has decreased depth and area within the lake. No other pollution problems were identified by department personnel during the 2014 survey.

Observations on condition of structures (i.e. spillway, boat ramps and docks, roads, etc)

The spillway pipe has a hole in it and is eroding the area around it. The spillway is on the list to be repaired in fall 2015. A new boat ramp was installed in 2005. Also, in 2009 a boat dock was reconditioned by the Rapid City Area Chapter of Walleyes Unlimited and installed by the SDGFP.

MANAGEMENT OBJECTIVES

Objective 1. To maintain a walleye fishery with a minimum gill-net CPUE for stock-length walleye of 10 and a PSD range of 30-60.

Objective 2. To maintain a largemouth bass fishery with a minimum nighttime electrofishing CPUE for stock-length fish of 20 and PSD range between 40 and 70.

Objective 3. Maintain a black crappie population with a trap net CPUE of at least 20 and PSD of greater than 40.

Objective 4. Experimentally stock 50–100 adult gizzard shad to improve the forage density.

BIOLOGICAL DATA

Sampling Effort and Catch

Age-0 Fish Survey

Daytime boat electrofishing was used on August 4th to index gizzard shad reproduction. Electrofishing was done using a boat mounted Smith-Root unit with pulsed-DC. Sampling consisted of five stations totaling 30 minutes of electrofishing (Table 1). Gizzard shad reproduction has been very successful and age-0 fish were captured at all five stations.

Table 1. Site number, number collected per site (No./Site), effort, and estimated number per hour of gizzard shad sampled using daytime electrofishing from Curlew Lake, Meade County, South Dakota, August 4, 2014.

Site	No./Site	Effort (sec)	No./hr
1	15	300	180
2	2	600	12
3	65	300	780
4	136	300	1,632
5	57	300	684
Total	275	0.5 hr	550.0

Adult Fish Survey

Trap nets and gill nets were used on May 27-29, 2014 to index adult fish populations in the reservoir (Figure 1). The net sampling consisted of eight trap net nights and two gill net nights and catch data is displayed in Tables 2 and 3. Fall electrofishing was completed on September 16, 2014, to sample the bass and walleye population. Electrofishing results are in Table 4. Discussion on selected fish species follows and completes this report.

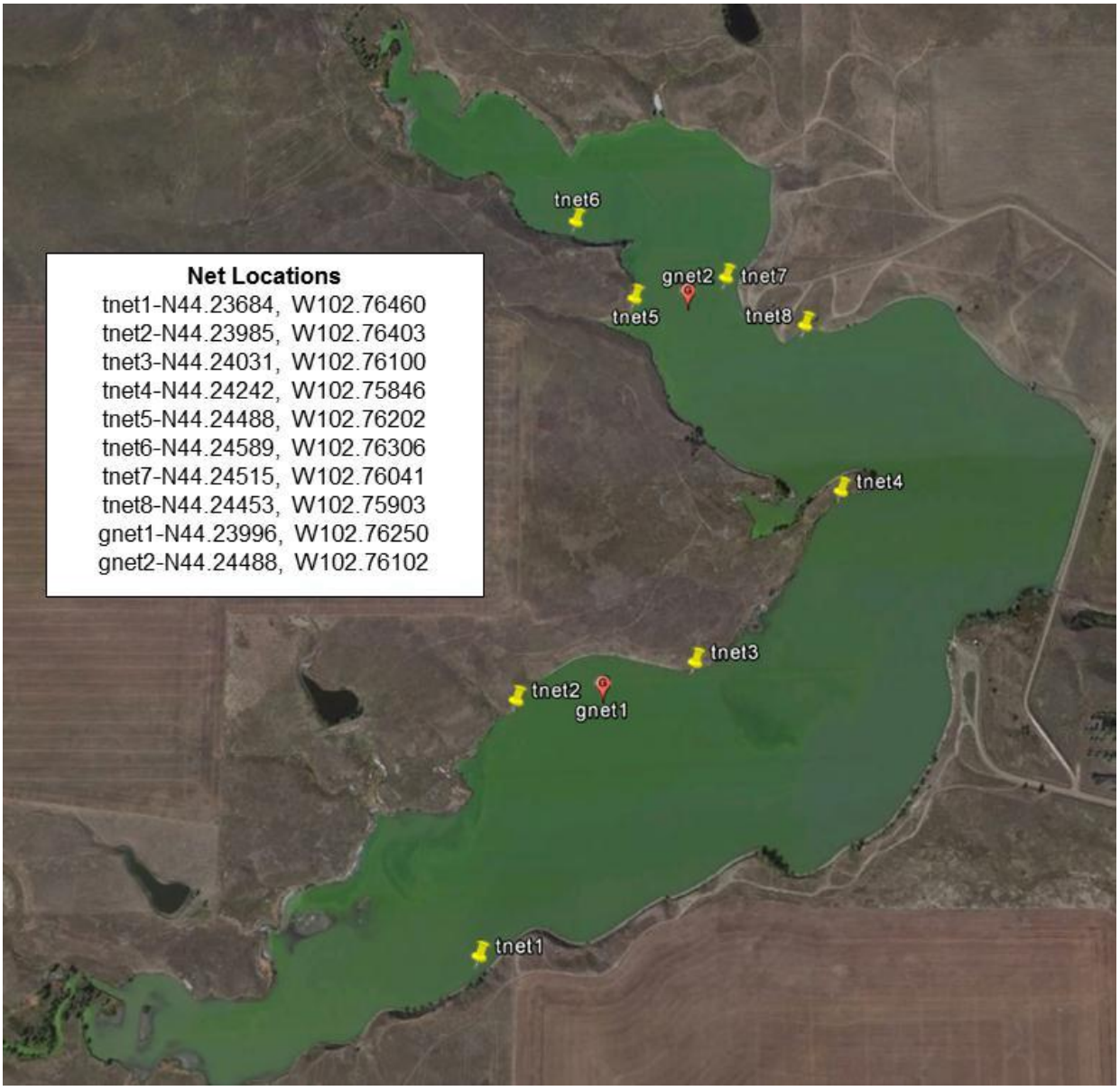

Figure 1. Locations of experimental gill (gnet) and modified fyke (tnet) nets during the annual fisheries survey in Curlew Lake, Meade County, South Dakota, 2014.

Table 2. Catch data from all species collected in eight trap nets in Curlew Lake, Meade County, May 27-29, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	*Wr* ≥ S
Black bullhead	489	61.1 (58.0)	56.5 (53.6)	2 (2)	0	69.5 (1.6)
Black crappie	314	39.3 (20.3)	39.3 (20.3)	52 (5)	35 (4)	88.7 (1.3)
Bluegill	16	2.0 (1.5)	2.0 (1.5)	6 (11)	0	98.0 (2.7)
Channel catfish	2	0.3 (0.2)	0.0 (--)	--	--	--
Common carp	1	0.1 (0.2)	0.0 (--)	--	--	96.9 (--)
Walleye	12	1.5 (1.1)	0.8 (0.4)	100	17 (33)	84.5 (1.3)
White sucker	1	0.1 (0.2)	0.1 (0.2)	--	--	106.8 (--)
Yellow perch	2	0.3 (0.2)	0.3 (0.2)	--	--	74.2 (20.6)

Table 3. Catch data from all species collected in two gill nets in Curlew Lake, Meade County, May 27-29, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	*Wr* ≥ S
Black bullhead	4	2.0 (0.0)	0.5 (1.5)	--	--	78.4 (--)
Black crappie	34	17.0 (21.5)	17.0 (21.5)	3 (5)	3 (5)	91.3 (0.4)
Channel catfish	3	1.5 (1.5)	1.5 (1.5)	--	--	102.0 (6.8)
Common carp	2	1.0 (0.0)	0.5 (1.5)	--	--	--
Gizzard shad	3	1.5 (1.5)	1.5 (1.5)	--	--	85.7 (16.7)
Northern pike	1	0.5 (1.5)	0.5 (1.5)	--	--	90.4 (--)
Walleye	42	21.0 (27.7)	17.0 (24.6)	59 (15)	0	84.2 (1.0)
Yellow perch	11	5.5 (4.6)	4.5 (1.5)	11 (21)	0	76.6 (3.3)

Table 4. Catch data for largemouth bass, smallmouth bass and walleye collected from 49.8 minutes of electrofishing in Curlew Lake, Meade County, South Dakota, September 16, 2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr*≥S values with 90% confidence intervals in parentheses

Species	N	CPUE	CPUE-S	PSD	PSD-P	*Wr* ≥ S
Largemouth bass	21	25.4 (15.4)	16.9 (9.8)	36 (24)	7 (13)	114.3 (4.0)
Smallmouth bass	1	1.2 (1.8)	1.2 (1.8)	--	--	109.0 (--)
Walleye	132	158.6 (74.6)	134.6 (54.2)	32 (7)	3 (2)	100.9 (0.6)

Black bullhead

Black bullhead abundance was similar to last year. Trap net CPUE was 61.1, similar to the 68.8 last year (Tables 2 and 5). Stock density values indicate a population dominated by small fish with a PSD value of only 2 and PSD-P at 0. Again, similar to last year's PSD of 1 and PSD-P of 0. Mean condition (*Wr*) for stock length and larger black bullheads was very low at 69.5. Although no age data was collected, length frequencies suggest a strong year class or two under quality length (Figure 2).

Table 5. Composite listing of data for black bullhead collected by trap nets in Curlew Lake, 2006-2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	*Wr*≥S
2006	4	0.6 (0.6)	0.6 (0.6)	100	50 (50)	103.6 (5.0)
2007	1	0.1 (0.2)	0.1 (0.2)	0	0	77.6 (--)
2008	25	3.1 (1.2)	2.9 (1.3)	13 (12)	0	105.6 (3.6)
2009	105	17.5 (11.0)	13.5 (10.3)	9 (6)	0	82.8 (9.4)
2010	532	88.7 (62.8)	37.2 (27.0)	5 (3)	0	75.4 (2.2)
2011	1500	187.5 (46.9)	185.5 (46.4)	4 (1)	0	93.6 (2.2)
2012	478	59.8 (21.3)	59.8 (21.3)	3 (1)	0	86.2 (1.7)
2013	550	68.8 (18.6)	65.9 (17.7)	1 (1)	0	82.8 (1.5)
2014	489	61.1 (58.0)	56.5 (53.6)	2 (2)	0	69.5 (1.6)

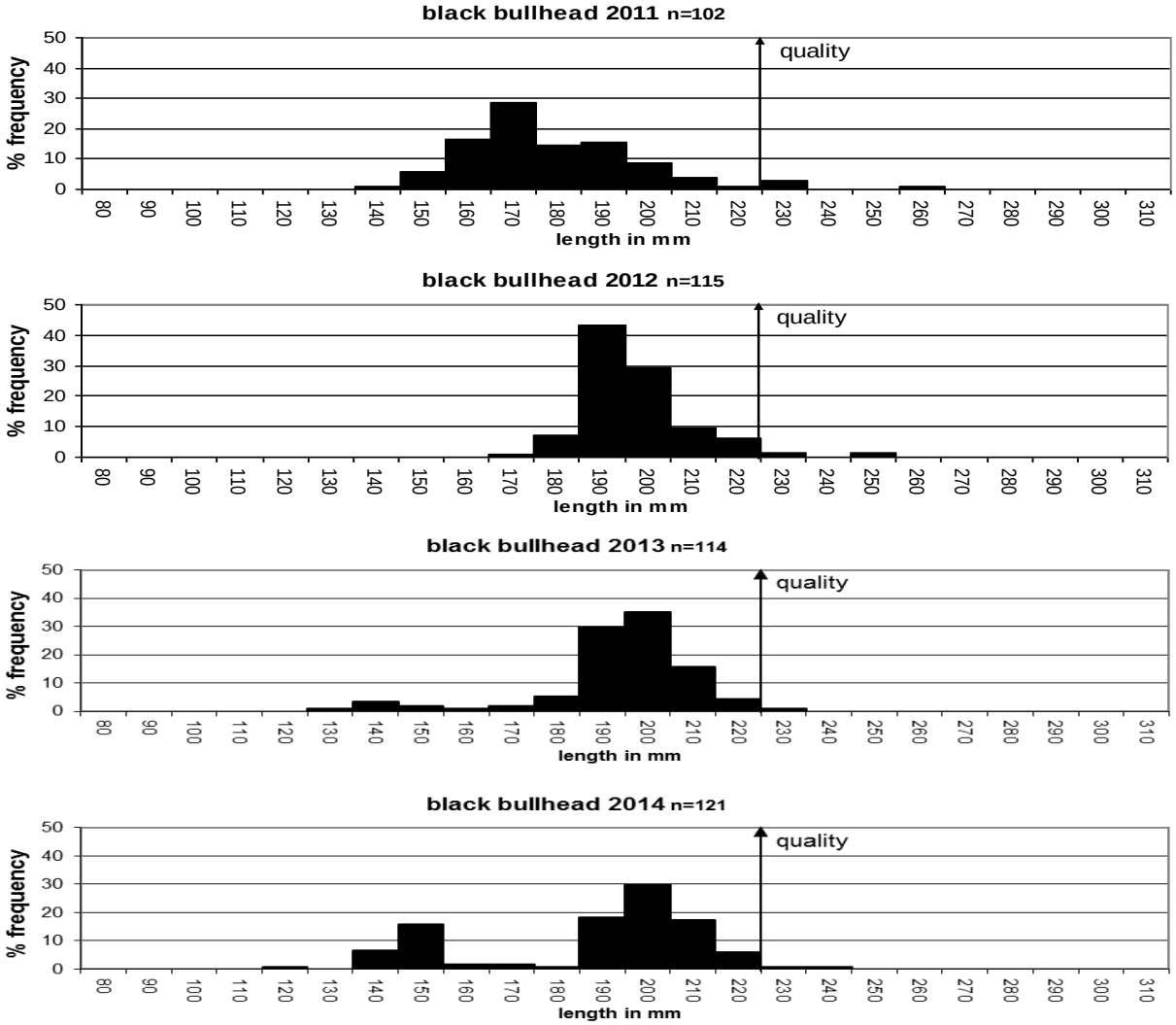

Figure 2. Length frequencies of black bullheads from trap nets in Curlew Lake, 2011-2014.

Black crappie

Black crappie abundance was a bit lower than last year. Trap net CPUE was 39.3, compared to 88.0 last year (Tables 2 and 6). Size structure was similar to last year with a PSD of 52 in 2014 and 59 in 2013. Also in the 2012 survey, no black crappies were sampled over the preferred-length of 250 mm (Figure 3). That same year, the first stocking of gizzard shad occurred. Since that stocking, PSD-P has steadily increased and is at an all-time high of 35 this year. Growth is good, well above the regional average and above the statewide average for most year classes (Table 7).

Table 6. Composite listing of data for black crappie collected by trap nets in Curlew Lake, 2006-2014. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and *Wr* with 90% confidence intervals in parentheses.

Year	CPUE	CPUE-S	PSD	PSD-P	*Wr*≥S
2006	178.3 (97.8)	12.3 (9.2)	91 (6)	0	84.5 (0.2)
2007	353.1 (111.7)	216.4 (68.7)	17 (2)	0	100.7 (1.3)
2008	54.6 (15.9)	48.9 (14.3)	9 (3)	2 (1)	107.4 (1.1)
2009	18.0 (10.1)	16.3 (9.0)	38 (8)	2 (2)	101.5 (0.7)
2010	19.8 (10.7)	19.7 (10.6)	34 (7)	2 (2)	93.3 (1.0)
2011	57.5 (25.7)	57.5 (25.7)	31 (4)	2 (1)	101.8 (0.7)
2012	107.3 (25.7)	61.1 (14.6)	43 (4)	0	102.5 (2.4)
2013	88.0 (22.4)	87.5 (22.3)	59 (6)	8 (3)	102.5 (0.9)
2014	39.3 (20.3)	39.3 (20.3)	52 (5)	35 (4)	88.7 (1.3)

Table 7**.** Curlew Lake black crappie scale aged year class, age in 2014, sample size (N), mean back-calculated total length-at-age, the Region 1 (western SD) mean length-at-age, and the South Dakota state-wide black crappie mean length-at-age (Willis et al 2001). Standard errors are in parentheses.

Year Class	Age	N	1	2	3	4	5	6
2011	3	179	94	159	179			
2010	4	12	90	164	200	259		
2009	5	58	82	153	193	244	262	
2008	6	23	90	156	188	204	253	276
2014 Pop. mean (SE)		272	89 (3)	158 (2)	190 (11)	236 (16)	258 (4)	276 (0)
2012 Pop mean (SE)		820	85 (4)	148 (6)	178 (8)	199 (2)	208 (0)	
Region 1			74 (3)	122 (7)	158 (9)	197 (13)	217 (16)	
South Dakota			83 (2)	147 (4)	195 (5)	229 (6)	249 (6)	

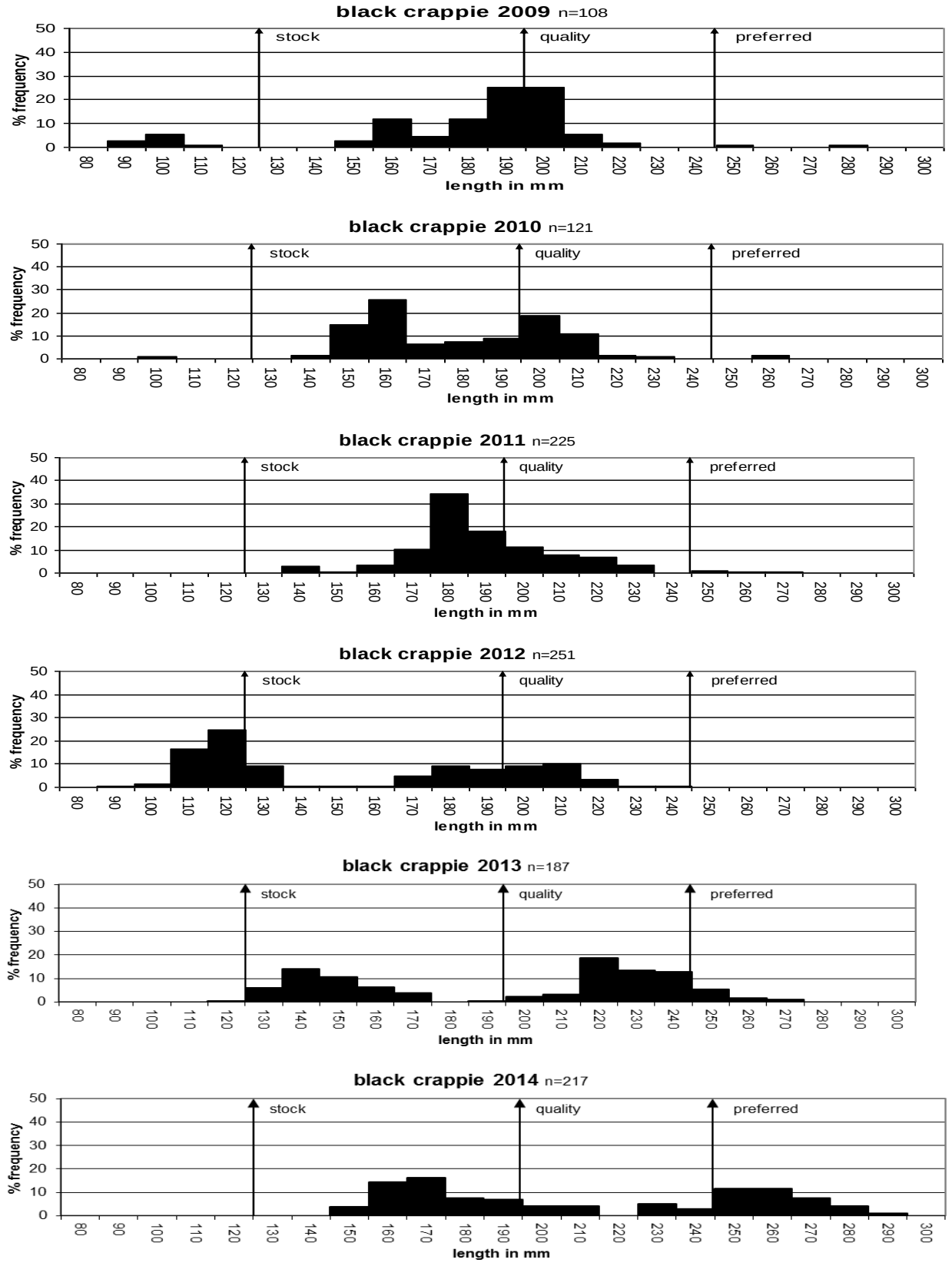

Figure 3. Length frequencies of black crappie from trap nets at Curlew Lake from 2009-2014.

Largemouth bass

Curlew Lake continues to have a low density, largemouth bass population with a fall night electrofishing CPUE of 25.4 (Table 4). The length frequency histogram shows most fish under twelve inches (Figure 4). These are probably from the one-year-old largemouth bass stocked in the spring of 2014. Fish condition was excellent with *Wr* of 114.3.

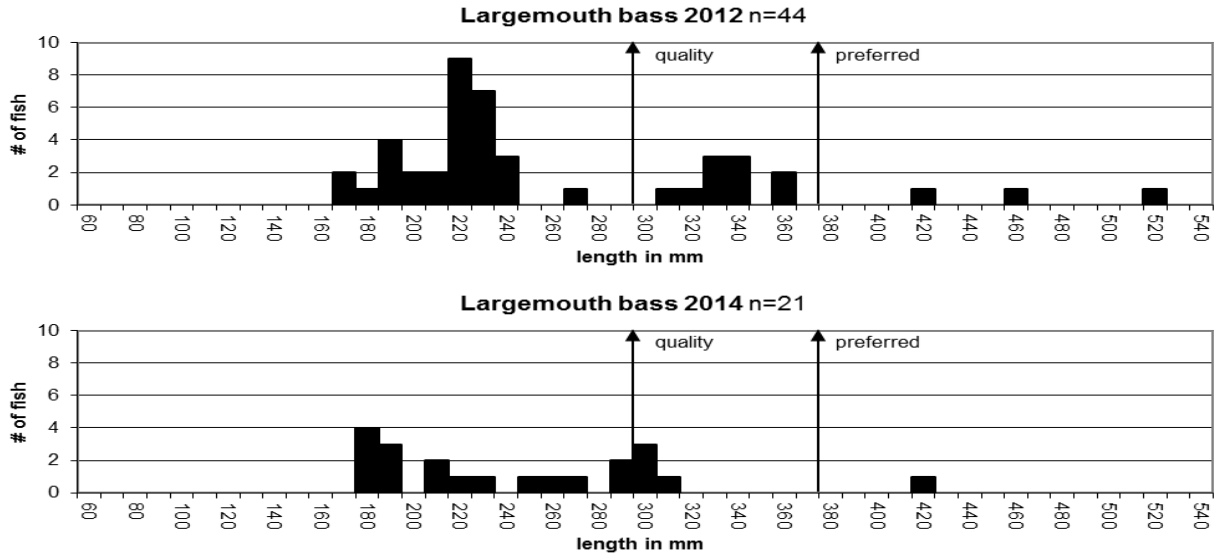

Figure 4. Length frequency histograms for largemouth bass from fall electrofishing at Curlew lake, 2012, 2014.

Walleye

To increase walleye abundance at Curlew Lake, a 14-inch minimum-length-limit for walleye was put in effect January 1, 2004. In 2010, that regulation changed to a 15-inch minimum and the limit was also dropped from a daily limit of four walleye in possession to two. Starting in 2008, small walleye fingerling stockings have been more frequent to improve the walleye density. However, density remained low. In 2010, two gill nets caught a total of three walleye for a CPUE of 1.5 and in 2012 the gill net CPUE was 4.5 (Table 8). Fish condition was poor with an average *Wr* for stock length and larger walleye of 80.8. In addition, otoliths aged from walleye in the gill net sample showed slow growth with four year old walleye averaging 326 mm (Table 9).

To improve walleye condition and growth, and associated survival, stockings of adult gizzard shad began in 2012 with the purpose to provide additional forage through high shad reproduction rates observed in other area reservoirs. Walleye survival does appear higher. Gill net CPUE for both 2013 and 2014 surpassed 20 fish per net (Tables 3 and 8). Fish condition was also higher with an average *Wr* of 95.8 last year and 84.5 this year. Growth has also improved with three year old walleye reaching an average of 15 inches. Curlew has become one of the fastest growing walleye populations in the region. Walleye numbers are now within the management objectives set for Curlew Lake.

In addition, fall electrofishing shows that natural reproduction is occurring and the large stocking of fall fingerlings in 2013 have recruited to the population (Figure 5). Those stocked (now age-1) fish

were between 260 mm-340 mm showing excellent growth. Growth data from late May gill nets shows fish are reaching the 15-inch minimum in the summer of their third year (Table 11).

Table 8**.** Composite listing of data for walleye collected by gill nets in Curlew Lake, 2008-2014. CPUE's with 80% confidence intervals in parentheses. *Wr* ≥S with 90% confidence interval in parentheses.

Year	N	CPUE	CPUE-S	*Wr*≥S
2008	1	0.5 (0.3)	0.5 (0.3)	
2009	11	5.5 (13.9)	0.0 (--)	--
2010	3	1.5 (4.6)	0.0 (--)	--
2012	9	4.5 (1.5)	4.5 (1.5)	80.8 (4.0)
2013	55	27.5 (10.8)	27.5 (10.8)	95.8 (1.0)
2014	42	21.0 (27.7)	17.0 (24.6)	84.5 (1.3)

Table 9**.** Curlew walleye length range and weighted mean length (mm) at capture by otolith ages from gill net sample July 4-6, 2012.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	Number of fish in survey
4	254	326	395	8
7	690	690	690	1

Table 10. Curlew walleye length range and weighted mean length (mm) at capture by otolith ages from gill net sample June 10-12, 2013.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	Number of fish in survey
2	280	299	332	12
3	312	350	372	4
4	363	373	386	4
5	352	410	493	53

Table 11. Curlew walleye length range and weighted mean length (mm) at capture by otolith ages from gill net sample May 27-29, 2014.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	Number of fish in survey
1	199	217	228	6
2	304	324	344	2
3	362	379	407	19
4	410	410	410	1
6	383	439	485	12

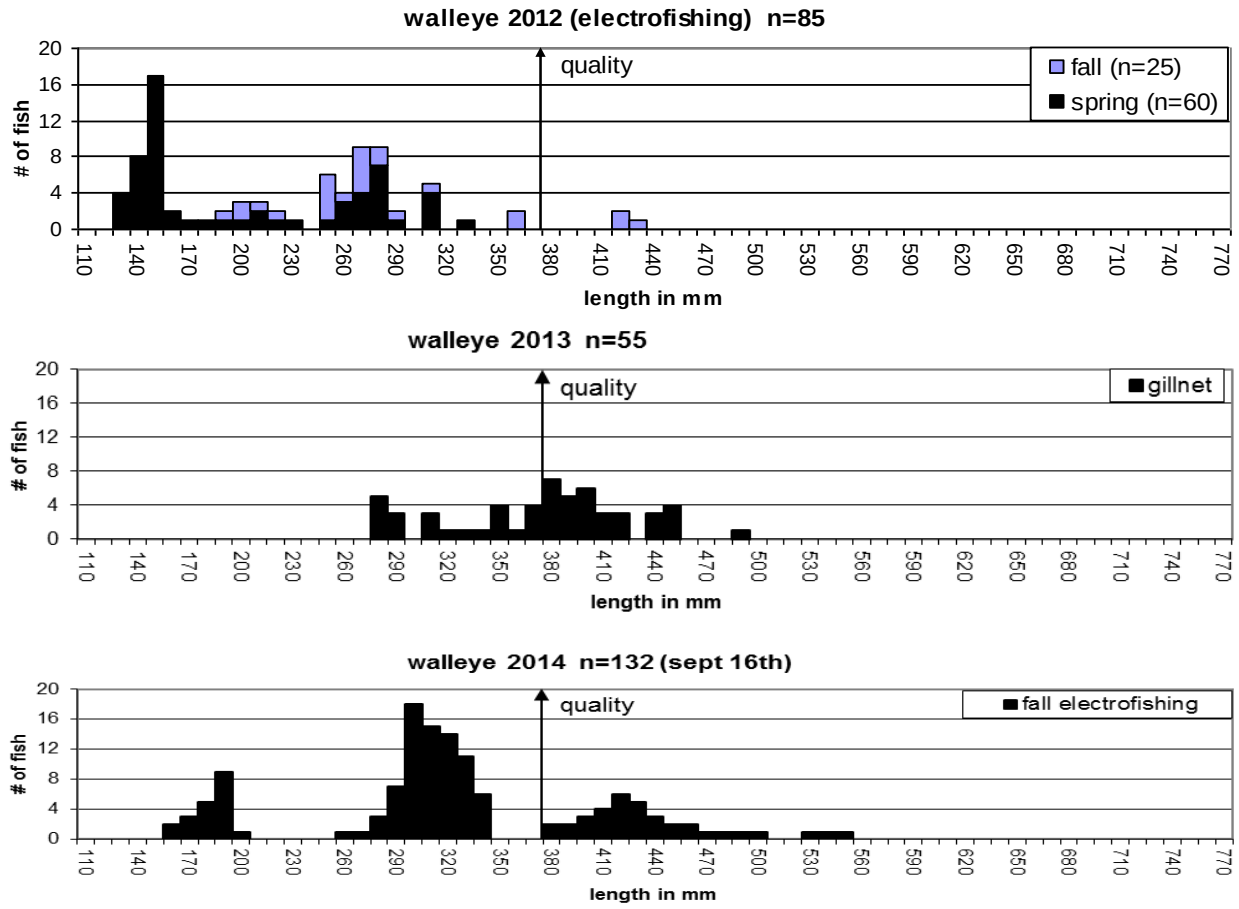

Figure 5. Length frequency of walleye sampled from Curlew Lake, Meade County, 2012-2014.

RECOMMENDATIONS

1. Survey fish populations annually while gizzard shad stockings are being accomplished to document changes in fish populations (i.e. size structure, densities, growth, condition) that may be associated with gizzard shad as a new forage source.

LITERATURE CITED

Willis, D.W., D.A. Isermann, M.J. Hubers, B.A. Johnson, W.H. Miller, T.R. St. Sauver, J.S. Sorenson, E.G. Unkenholz, and G.A. Wickstrom. 2001. Growth of South Dakota Fishes: A Statewide Summary with means by region and Water Type. Special Report. South Dakota Department of Game, Fish and Parks. Pierre, South Dakota.

APPENDIX

Appendix A. Stockings in Curlew Lake, Meade County, 2008-2014.

Year	Number	Species	Size
2008	46,990	Walleye	Fingerling
	13,000	Largemouth bass	Fingerling
2009	70	Channel catfish	Adult
	400	Yellow perch	Adult
	150	Largemouth bass	Adult
	23,960	Largemouth bass	Fingerling
	46,260	Walleye	Fingerling
2010	250	Golden shiner	Adult
	14,000	Walleye	Fingerling
	8,420	Largemouth bass	Fingerling
2011	200	Channel catfish	Adult
	1,398	Yellow perch	Adult
2012	54	Gizzard shad	Adult
	13,320	Largemouth bass	Fingerling
2013	35	Gizzard shad	Adult
	4,000	Walleye	Large fingerlings
2014	400	Largemouth bass	Juvenile
	50	Gizzard shad	Adult
	650	Yellow perch	Adult
	200	Channel catfish	Adult